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To the knowledge on Southeast Asian species of the genera *Tetraripis* and *Angilia* (Heteroptera: Veliidae)

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Abstract: Oriental species of the Veliidae genera *Tetraripis* and *Angilia* are studied. *Tetraripis bituberculatus* sp.n. from Borneo (Indonesia: Kalimantan Timur and Kalimantan Barat) is described. The macropterous male of *Angilia borneensis* ZETTEL & HECHER 1998 and the macropterous female of *Angilia mazzoldii* ZETTEL & HECHER 1998 are described for the first time. New distribution data of further three species of *Tetraripis* and further four species of *Angilia* are provided. First country records are: *Angilia bispinosa* ANDERSEN 1981 from Laos and *A. mazzoldii* from Malaysia (Sabah).

Key words: Heteroptera, Veliidae, Rhagoveliinae, Veliinae, *Angilia*, *Tetraripis*, new species, new record, Indonesia, Malaysia, Thailand, Laos, Philippines, India, Sri Lanka.

Introduction

This paper presents new records and new descriptions of species of the genera *Angilia* STÅL 1865 and *Tetraripis* LUNDBLAD 1936. *Angilia* is placed in the subfamily Veliinae, but the phylogenetic position of *Tetraripis* has been discussed very controversially in recent studies: POLHEMUS (1997) and POLHEMUS & POLHEMUS (1999) recognize *Tetraripis* as a representative of the Veliinae with close relationship to *Angilia*, but ANDERSEN (2000) follows earlier conceptions (LUNDBLAD 1933, ANDERSEN 1982, ZETTEL 1995) with *Tetraripis* as a genus of Rhagoveliinae. The monophyly of the Rhagoveliinae with the genera *Rhagovelia* MAYR 1865, *Tetraripis*, and *Chenevelia* ZETTEL 1996 has been broadly discussed by ANDERSEN (2000) and seems well argued. The monophyly of the Veliinae, however, is presently not satisfactorily confirmed.

Independent of their phylogenetic positions, *Angilia* and *Tetraripis* have many similarities in general appearance, which might have convergently developed in similar cryptic aquatic habitats. The latter is probably the reason for the fact that specimens of both genera are generally rarely represented in collections. This paper reports mainly the material in the Raffles Museum of Biodiversity Research, National University of Singapore, but includes additional material from other collections.

Repositories of specimens:

CSS Coll. William D. Shepard, California State University, Sacramento, U.S.A.
CSW Coll. Franz Seyfert, Vienna, Austria

- CUL Coll. W. Ullrich, Lübeck, Germany
 CZW Coll. H. & S.V. Zettel, Vienna, Austria
 MZB Museum Zoologicum Bogoriense, Bogor, Indonesia
 NHMW Naturhistorisches Museum in Wien, Vienna, Austria
 UPLB Museum of Natural History, University of the Philippines, Los Baños, Laguna, Philippines
 ZRCS Raffles Museum of Biodiversity Research (Zoological Reference Collection), National University of Singapore

Genus *Tetraripis* LUNDBLAD 1936

The genus *Tetraripis* is strictly Oriental. Eight species have been described and keys to species are presented by POLHEMUS & POLHEMUS (1999) and ANDERSEN (2000). A ninth species is added here.

Check-list of species:

<i>asymmetricus</i> POLHEMUS & KARUNARATNE 1980	Sri Lanka, South India
<i>bituberculatus</i> sp.n.	Borneo
<i>borneensis</i> ZETTEL 1995	Borneo
<i>chinthe</i> POLHEMUS & POLHEMUS 1999	Myanmar
<i>doveri</i> LUNDBLAD 1936	Malay Peninsula
<i>drescheri</i> POLHEMUS & POLHEMUS 1999	Java
<i>kodadai</i> ZETTEL 1995	Borneo
<i>ravana</i> (KIRKALDY 1901)	Sri Lanka
<i>zetteli</i> ANDERSEN 2000	Thailand

Tetraripis bituberculatus sp.n. (Figs. 1-8)

Type material: holotype (apterous male): Indonesia: Kalimantan Timur, Kayan Basin, Sg. Nga'ha, roots overhanging bank, 24.XI.1999, leg. H.H. Tan & D. Wowor (THH9998) (MZB); paratypes: 3♂♂, 4♀♀ (apterous), same locality (ZRCS, MZB, NHMW); 16♂♂, 12♀♀ (apterous), 2 nymphs (nymphs no paratypes), Kalimantan Barat, Kabupaten Sanggau, Sosek-Sanggau Road to Pontianak (downstream, fast flowing after heavy rain), 26.IX.1998, leg. H.K. Lua, H.H. Tan & D. Wowor (LHK382) (MZB, ZRCS); 1♀ (apterous), Kalimantan, Apokayan, Long Ampung, Lidung Payau, Sungan River, 720 m, 29.XII.1997, leg. P. Mazzoldi (CZW); 1♀ (apterous), same area, Sungai Barang, Wai River, 850 m, 1.I.1998, leg. Mazzoldi (CZW).

Description: Apterous male: body length 4.7 - 4.9 mm; maximum body width (across mesacetabula) 1.4 - 1.5 mm; body slender.

Colour: dorsally yellowish brown (greenish in live animals) with most of pronotum (except antero-medially), lateral areas of tergite 1 and 2, most of tergites 3 and 4, and small dots latero-distally on all laterotergites dark brown; laterally and ventrally predominantly blackish brown; antenna and legs yellow with brownish annulation; antennomere 1 basally and apically, antennomere 2 in distal half, antennomeres 3 and 4 mostly (except extreme base) dark brown; profemur with two brownish stripes in distal half, meso- and metafemur and all tibiae each with three stripes: basally, medially, and apically; tarsi partly infuscated; pairs of very obvious silverish spots (originating from very short hairs) anteriorly on pronotum and laterally on tergites 1 and 2; lateral areas of body partly with more indistinct silverish shine.

Pilosity: whole body, antennae, and legs with numerous long, erect, light brownish setae; abdomen, in addition, with numerous shorter, semi-erect, yellowish setae; body without small black spiculae.

Structures: head: juga vertical, broad; antenna long, antennomere 1 approximately 1.3 times head width; relative lengths of antennomeres as 1.3 : 1 : 0.9 : 0.65.

Pronotum including lobe 2.4 times as long as eye length; pronotal lobe completely covering mesonotum, anteriorly with low median carina; relative lengths of leg segments of holotype (in relation to mesofemur = 100): profemur 61, protibia 67, protarsus 21, mesofemur 100, mesotibia 87, mesotarsus 4+21+40, metafemur 101, metatibia 106, metatarsus 4+8+25; metatrochanter ventro-distally with several black granules; metafemur (Fig. 3) incrassate, 3.3 - 3.4 times as long as wide (without teeth), ventrally with numerous teeth: basal row consisting of approximately 7 - 8 teeth, distal tooth longest; distal row consisting of approximately 10 - 12 teeth, basal tooth much longer than other teeth which of irregular lengths, most distal tooth usually in distance from others; anterior distal row not present; metatibia (Fig. 3) evenly curved, on internal surface with numerous granules and with long preapical spine, apically produced into spine.

Abdomen elongate; tergites 1 - 3 strongly convex, tergites 4 - 7 weakly convex; seventh tergite 1.05 times as long as tergite 2, 2.1 times as long as tergite 6, and 0.65 times as long as wide at hind margin; tergite 5 medially, tergites 6 and 7 completely shining, but shine reduced by numerous minute hair pits; laterotergites flat and broad, laterotergites 4 and 5 widest; connexiva terminating in small sharp spines; sternite 6 medianly grooved, elevations lateral of this groove posteriorly highest, terminating in pair of tubercles which surpassing anterior margin of sternite 7 (Figs. 7, 8); sternite 7 with low median carina and indistinct, small tubercles close to anterior margin; segment 8 long, ventrally with low transverse carina anteriorly and with median carina posteriorly; proctiger with weakly delimited basal and distal part, with distal third densely pilose (Fig. 4); parameres (Figs. 5, 6) symmetrical, curved dorsad, basally with several setae, with dorsal and ventral margin subparallel, apically tapered and terminating into blunt tip.

Apterous female: Body length 5.5 - 6.0 mm; maximum body width (across metacetabula) 1.7 - 1.8 mm; body shape similar as in male, but posterior segments of abdomen much more elongate (Fig. 1); colour as in male, except tergite 3 with pair of silverish spots (small in females from the Kayan Basin, large in females from Apokayan); pilosity and structural characteristics partly different from male:

Metatrochanter without black granules; metafemur less incrassate, 3.7 - 4.0 times as long as wide, ventrally with 10 - 14 small teeth, without distinct separation between basal and distal row; metatibia less curved, with granules smaller and less numerous.

Abdomen (Fig. 1) very elongate; tergites 1 - 3 strongly convex, 4 slightly convex, 5 transversely impressed, 6 - 8 nearly flat; seventh tergite 1.0 times as long as tergite 2, 1.05 times as long as tergite 6, and 1.5 times as long as wide at hind margin; tergites 1 - 5 matt, 6 - 8 shining; tergites 1 - 3 with long erect setae, tergite 4 with slightly shorter setae except posteromedially, tergite 7 and 8 along hind margin with dense, posteriad directed pilosity; tergites 6 - 7 with dense short pubescence, which hardly developed on other tergites; connexiva anteriorly slightly converging, at segment 4 - 5 strongly converging, and posteriorly subparallel, terminating in very small tips (Fig. 2); laterotergites directed dorso-laterally, posteriorly more steep, with numerous long erect setae; laterotergite 5 posteriorly at connexival margin with distinct swelling; in lateral view (Fig. 2) ventral

outline of sternites 5-6 concave, of sternite 7 convex (in variable degrees), of gonocoxa slightly concave; proctiger long and narrow.

Comparative notes: *Tetraripis bituberculatus* sp.n. is closely related to *T. kodadai*. The main difference between these two species is found in the sternite 6 of the male: In *T. kodadai* sternite 6 bears a short ventral plate which protrudes posteriad and bears two small knobs close to midline (Fig. 9). In *T. bituberculatus* sp.n. sternite 6 is medianly all over its length broadly impressed and bears lateral of this impression, close to the hind margin two large tubercles (Fig. 8). Sternite 7 of the male of *T. kodadai* is medianly highly carinate and bears a pair of small, but distinct tubercles close to anterior margin (Fig. 9); these structures are weakly developed in *T. bituberculatus* sp.n. (Fig. 8). Other differences should be proven in more specimens: *Tetraripis bituberculatus* sp.n. is lighter in colour, and the apterous female is larger in the size (5.5 - 6.0 mm vs. 5.1 mm in *T. kodadai*) and with more long setae on tergite 4. In the key to species POLHEMUS & POLHEMUS (1999: 128) state that the male of *T. kodadai* has the "sternite V with two prominent posteriorly directed tubercles". However, neither in *T. kodadai* nor in *T. bituberculatus* sp.n. sternite 5 has such a modification. POLHEMUS & POLHEMUS (1999) refer to non-type material from the Tapah River in Sarawak. Probably these specimens represent another undescribed species, if sternite 6 has not been mistaken for sternite 5.

Etymology: The new species is named after the two characteristic tubercles on sternite 6 of the male.

***Tetraripis asymmetricus* POLHEMUS & KARUNARATNE 1980 (Figs. 10, 11)**

Material examined: Sri Lanka: paratypes: 2♂♂, 4♀♀ (apterous), Southern Province, Padukka, Arakawili Jungle, stream, 30.VIII.1968, leg. Karunaratne & Bartholomeusz (NHMW); other specimens: 1♂ (apterous), Badulla District, Wewesse Tea Estate along Badulla-Passara Road, 22.IX.1997, leg. M.M. Bahir & K. Lim (KSL7) (ZRCs); 1♂, 1♀ (apterous), Monoragala District, small stream between Bibille and Lunugala, 7 mls from Bibille (7°5,5'N, 81°12,9'E), 1888 ft., 22.IX.1997, leg. M.M. Bahir & K. Lim (KSL8) (ZRCs); India: 1♀ (apterous), Karnataka, Coorg, Kakkabe env., 23.XII.1998, 12°15'N 75°35'E, 900 - 1200 m, leg. D. Boukal (18) (NHMW); 1♂ (apterous), Kerala, 30 km NNE Trivandrum, 400 m, Kallar Bridge, 08°45'N 77°05'E, 31.XII.1998, leg. D. Boukal (31) (NHMW); 2♂♂ (macropterous), Kerala, 10 km W Munnar, Peechadu - Mangulan road, 1100 m, 10°04'N 76°58'E, 6.I.1999, leg. D. Boukal (48) (NHMW).

Notes: This species has been described and illustrated by POLHEMUS & KARUNARATNE (1980) from specimens from Sri Lanka. THIRUMALAI & DAM (1996) reported it from southern India for the first time. New records and descriptive notes have been added by POLHEMUS & POLHEMUS (1999) and ANDERSEN (2000).

Tetraripis asymmetricus is a very peculiar species which differs strongly from all other congeners in the asymmetrical genitalia of the male and a medianly carinate tergite 7 of the "typical" apterous female (Fig. 10). However, as already pointed out by POLHEMUS & POLHEMUS (1999), there are "two forms of apterous females", which differ strongly in the abdominal structures (see Figs. 10 and 11). POLHEMUS & POLHEMUS (1999) describe the differences in the reflexion of the connexiva and the shape of the distal tergites. It is most noteworthy to add, that the females with the "simple abdomen" (i.e., with connexiva hardly reflexed over tergites and with distal tergites broad and flat) have well developed abdominal carinae on tergites 1-4 (Fig. 11), which otherwise are found only in macropterous Veliidae. However, the thoracic structures of all apterous individuals are similar. It seems likely that the "atypical form" has developed from wing-pad-bearing nymphs.

The genitalia of the examined males vary considerably in the shape of the parameres and - even more - in the peg row on segment 8, so that it seems possible that *T. asymmetricus* is an unsolved complex of several species. However, with the limited material now examined, such a conclusion would be premature.

***Tetraripis doveri* LUNDBLAD 1936**

Material examined: West Malaysia: 1♂ (apterous) Johore, Sungai Pantai Burong, Endau - Rompin, 13.VII.2001, leg. C.M. Yang (YCM259) (ZRCS); 1♀ (apterous), Selangor, Gombak, 15.II.1995, leg. C.M. Yang (YCM82) (ZRCS).

***Tetraripis zetteli* ANDERSEN 2000**

Material examined: Thailand: paratypes: 1♂, 1♀ (apterous), Southwestern Thailand, Prachuab Khiri Khan Prov., Hua Hin, 6.-7.IX.1981, leg. P. Nielsen (NHMW); other specimen: 1♀ (apterous), North Thailand, Chiang Rai Prov., N Chiang Rai, 5 km before Mae Chan, 12.VI.1998, leg. Y.Y. Goh (GYY80) (ZRCS).

Genus *Angilia* STÅL 1865

All Oriental species belong to the subgenus *Adrienella* POISSON 1942. The Southeast Asian species have been treated by ANDERSEN (1981). ZETTEL & HECHER (1998) described three species from Borneo and arranged the seven Oriental species in two species groups. Records have been added by POLHEMUS & POLHEMUS (1999). POLHEMUS & POLHEMUS (in press) present first records of *A. orientalis* and *A. bispinosa* from Vietnam.

Check-list of species:

<i>Angilia orientalis</i> group	
<i>mazzoldii</i> ZETTEL & HECHER 1998	Borneo
<i>orientalis</i> ANDERSEN 1981	Thailand, Myanmar, China (Hong Kong), Vietnam, Philippines (Busuanga)
<i>philippiensis</i> DRAKE & HOBERLANDT 1953	Philippines (Luzon, Mindoro)
<i>Angilia bispinosa</i> group	
<i>anderseni</i> ZETTEL & HECHER 1998	Borneo
<i>bispinosa</i> ANDERSEN 1981	Thailand, Myanmar, Laos, Vietnam
<i>borneensis</i> ZETTEL & HECHER 1998	Borneo
<i>trispinosa</i> ANDERSEN 1981	Sumatra

***Angilia orientalis* species group**

***Angilia (Adrienella) mazzoldii* ZETTEL & HECHER 1998 (Figs. 12, 16, 18, 19)**

Material examined: Indonesia: 1♂, 2♀♀ (macropterous), Kalimantan Timur, Kayan Basin, Sg. Bako, 23.XI.1999, leg. H.H. Tan & D. Wowor (THH9996) (MZB, ZRCS, NHMW); 3♂♂, 1♀ (macropterous), East Kalimantan, E Malinau, E Tarakan, Pulau Sapi, tributary of Mentarang, 3.VIII.1999, leg. P. Mazzoldi (5, 6) (CZW); 1♂ (macropterous), East Kalimantan, Malinau, E Tarakan, small tributary, 6.VIII.1999, leg. P. Mazzoldi (18) (CZW); Malaysia: 1♂ (macropterous), Sabah, Maliau Basin, Tibow Estate, stream, 25.V.1995, leg. T.B. Lim (MB42) (ZRCS).

Notes: This species has been described by a single male from East Kalimantan, Samarinda area. The description of the female is here presented for the first time. The key characters used by ZETTEL & HECHER (1998) are stable in all specimens examined. The male from Sabah, which represents the first record of this species from Malaysia, differs slightly in the mediad curved ventrolateral processes of the segment 8 (Fig. 18) and in the shape of the paramere (Fig. 16), but until more material is available for study, these differences are regarded intraspecific.

Description of macropterous female: body length 5.5 - 5.7 mm; maximum body width (across humeri) 2.1 - 2.2 mm; colour, pilosity, and most structural characteristics as in male except the following: protibia with grasping comb 0.44 - 0.46 times as long as tibia (Fig. 12); terminalia (Fig. 19): connexivum terminating in short, broadly rounded apex; lateral hind margin of sternite 7 strongly concave; gonocoxa widely exposed, without dorsal process; gonocoxa and proctiger with dense, long, erect hairs.

***Angilia (Adrienella) orientalis* ANDERSEN 1981**

Material examined: Thailand: 1♂ (macropterous), Loei, 2 km W Phu Kradung, Lam Phong Ko, 4.IV.1994, leg. W.D. Shepard (1052) (CSS); 1♂ (macropterous), Chiang Mai, ca. 10 km E Samoeng, 018°51'45.2"N 098°38'49.5"E, 11.IV.2000, leg. W.G. Ulrich (CUL); 2♀♀ (macropterous), Mukdahan, Phu Pha Thoep NP, 31.XII.1999, leg. P. Mazzoldi (21) (CZW).

***Angilia (Adrienella) philippiensis* DRAKE & HOBERLANDT 1953 (Fig. 14)**

Material examined: Philippines: 1♀ (macropterous), Luzon, Mountain Province, 5 km S Bontoc, Balitian River, 900 m, 27.II.1999, leg. F. Seyfert (16) (CSW); 1♀ (macropterous), Luzon, Northern Ecija, Carranglan, Maringalo, BDF Station, creek, 5.XI.1976, leg. A.A. Barroso (UPLB).

Notes: This is still a dubious species, because not enough material is accessible. The type series, two males, is described from Mindoro Occidental (DRAKE & HOBERLANDT 1953). Following interpretations, however, are based on females from the island of Luzon: ANDERSEN (1981) described and illustrated a female from La Union and recorded a nymph from Rizal. POLHEMUS & POLHEMUS (1999) recorded a macropterous female from Northern Ecija in Luzon; a second macropterous female of the same collection is found in UPLB (see above). The female from the Mountain Province, which represents the most northern collection site, agrees well with ANDERSEN's (1981) description of *A. philippiensis*; its grasping comb is consisting of a few small patches in the distal half of the protibia (Fig. 14).

***Angilia bispinosa* species group**

***Angilia (Adrienella) anderseni* ZETTEL & HECHER 1998**

Material examined: Indonesia: 2♀♀ (macropterous), Kalimantan Barat, Kabupaten Pontianak, peatswamp off Sungae Kepyang, 29.IV.1998, leg. H.K. Lua, H.H. Tan & D. Wowor (LHK388) (MZB, ZRCS).

***Angilia (Adrienella) bispinosa* ANDERSEN 1981**

Material examined: Laos: 1♂ (macropterous), Khammouan Prov., Ban Khoun Noeun env., 18°07'N 104°29'E, 250 m, 4.-16., 25.-30.XI.2000, leg. E. Jendek & P. Pacholátko (NHMW).

Notes: So far recorded from Thailand and Myanmar. Records from Vietnam by POLHEMUS & POLHEMUS (in press). First record from Laos!

***Angilia (Adrienella) borneensis* ZETTEL & HECHER 1998 (Fig. 13, 15, 17)**

Material examined: Indonesia: 1♂, 1♀ (macropterous), Kalimantan Timur, Makaham Basin, Long Iram Subdistrict, Sungai Lomi, slow flowing stream, 27.III.2000, leg. H.H. Tan (THH0019) (MZB, ZRCS).

Notes: This species has been described based on two females. The description of the male is here presented. The male of the most similar species, *A. trispinosa*, is still unknown. The key by ZETTEL & HECHER (1998) should be modified in that way, that the stated lengths of the protibial grasping comb refer to the females only.

Description of macropterous male: body length 7.1 mm; maximum body width (across humeri) 3.3 mm; colour, pilosity, and most structural characters as in males except the following: grasping comb of protibia 0.60 times as long as tibia length (Fig. 13); metatrochanter disto-ventrally with some black granules; metafeur more incrassate than in female, 4.0 times as long as wide, ventrally with numerous black granules, without larger teeth; metatibia with more numerous granules than in female; genitalia small; segment 8 (Fig. 17) ventrally with evenly curved, medially obsolete, transverse edge, length : width = 0.96 mm : 0.76 mm, with exposed areas bearing very long setae; pygophore small, subovate; proctiger, slender, with evenly convex sides; paramere (Fig. 15) very slender, falciform, and close to base abruptly bent.

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Zusammenfassung

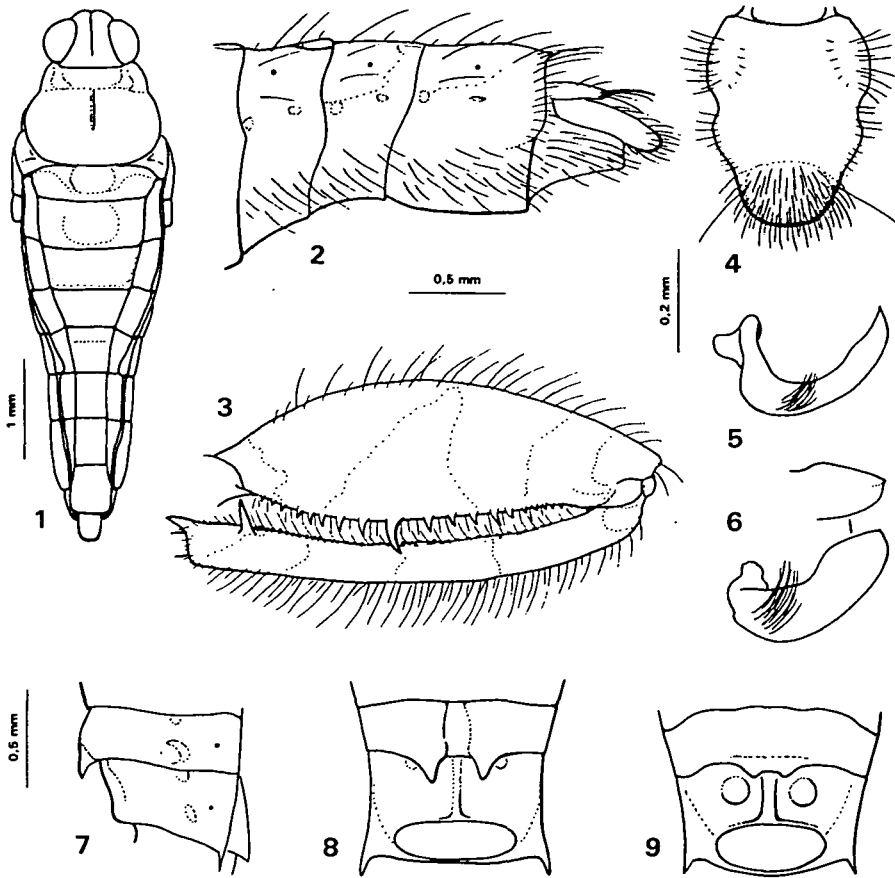
Orientalische Arten aus den Veliiden-Gattungen *Tetraripis* und *Angilia* werden untersucht. *Tetraripis bituberculatus* sp.n. aus Borneo (Indonesien: Kalimantan Timur und Kalimantan Barat) wird neu beschrieben. Das makroptere Männchen von *Angilia borneensis* ZETTEL & HECHER 1998 und das makroptere Weibchen von *Angilia mazzoldii* ZETTEL & HECHER 1998 werden zum ersten Mal beschrieben. Neue Verbreitungsangaben zu weiteren drei *Tetraripis*-Arten und weiteren vier *Angilia*-Arten werden gemacht. *Angilia bispinosa* ANDERSEN 1981 wird erstmals für Laos und *A. mazzoldii* erstmals für Malaysia (Sabah) nachgewiesen.

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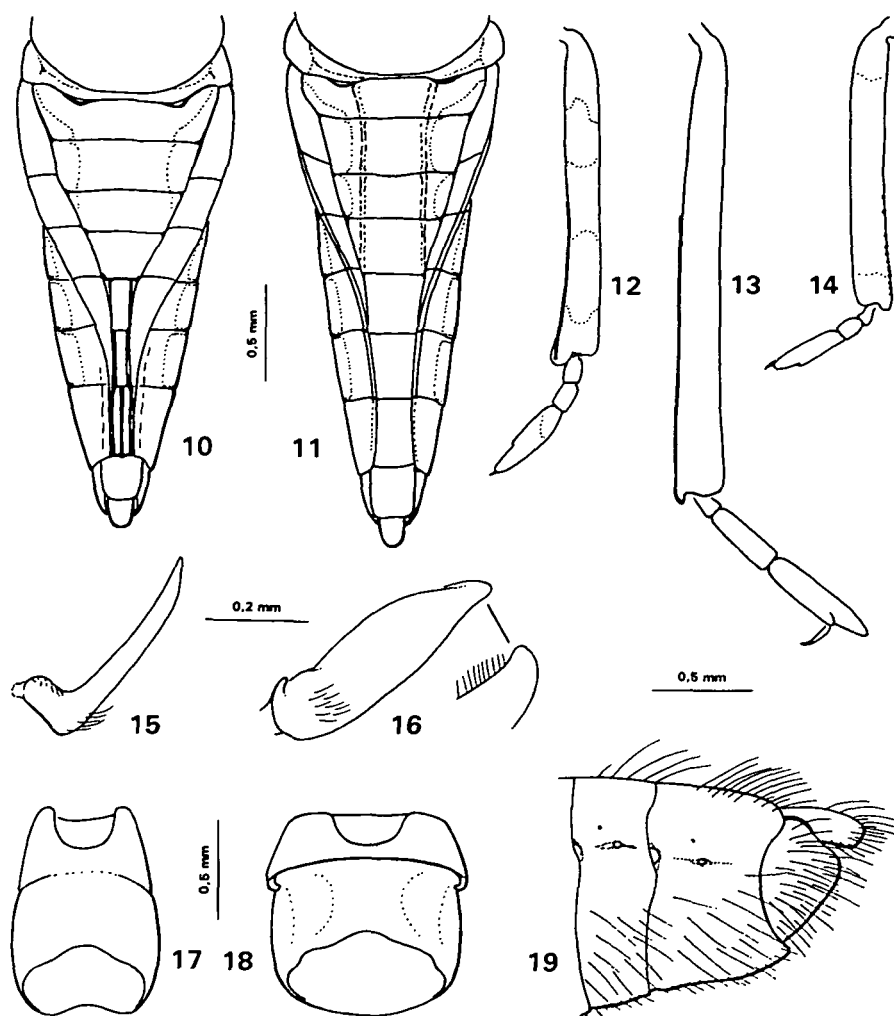
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Figs 1-9: (1-8) *Tetraripis bituberculatus* sp.n.: 1 – apterous female, dorsal aspect (appendages and pilosity omitted); 2 – apterous female, apex of abdomen, lateral aspect; 3 – metafemur and metatibia of apterous male, posterior aspect; 4 – proctiger, dorsal aspect; 5 – paramere, dorsal aspect; 6 – paramere, lateral aspect and apex in full face view; 7 – abdominal segments 6 and 7 of male, lateral aspect (pilosity omitted); 8 – same, ventral aspect; 9 – *Tetraripis kodadai*, same structures.



Figs 10-19: 10, 11 – *Tetraripis asymmetricus*, dorsal aspect of abdomina of the two "forms" of apterous females (pilosity omitted); 12 – protibia and protarsus (pilosity omitted) of female of *Angilia mazzoldii*; 13 – same structure of male of *Angilia borneensis*; 14 – same structures of female of *Angilia philippiensis* (from Mountain Province); 15 – paramere, lateral aspect, of *A. borneensis*; 16 – same structure of *A. mazzoldii* (from Sabah); 17 – abdominal segment 8 of male, ventral aspect, of *A. borneensis*; 18 – same structure of *A. mazzoldii* (from Sabah); 19 – *A. mazzoldii*, apterous female, apex of abdomen, lateral aspect.